



## Assessing reactivity to virtual reality alcohol based cues

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### Abstract

The use of virtual reality (VR) programs in behavioral science research has been gaining prominence over the past several years. In the field of substance abuse, VR cue reactivity programs have been successfully tested for feasibility in nicotine and cocaine dependent samples. Seeking to expand VR applications in alcohol cue research, a novel VR alcohol cue reactivity assessment system incorporating visual, auditory, and olfactory stimuli was developed and tested. In a controlled trial, 40 non-treatment-seeking drinkers with alcohol use disorders were exposed to VR alcohol cue environments. Subjective craving, attention to alcohol cues, and level of presence (realism of experience) in VR were assessed across the environments. Overall, subjective craving for alcohol increased across the VR alcohol-related cue environments versus VR neutral cue environments. Participants reported high levels of presence in VR, indicating that the environments were perceived as realistic and compelling. These initial findings support the use of VR based cue reactivity environments for use in alcohol cue-based treatment and research.

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In the US, according to the 2004 National Survey on Drug Use and Health, approximately 18.7 million people age 12 and older are classified with dependence on or abuse of alcohol ([Substance Abuse and Mental Health Services Administration, 2005](#)). An estimated 7.5 billion dollars are spent on alcohol treatment each year ([National Institute on Alcohol Abuse and Alcoholism, 2001](#)) in the United States. However, relapse

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rates remain high with most patients having 2 treatment admissions per year (SAMHSA, 2001). Given the high rates of relapse, increasing prevalence rates, and mortality, new treatment approaches that address biological, psychosocial, and environmental factors need to be developed in order to increase abstinence rates and reduce relapse.

A widespread method for assessing the impact of cues (triggers) related to alcohol use is referred to as cue reactivity study. Cue reactivity to alcohol-related cues is thought to be based in part on classical conditioning theory (Pavlov, 1927; Tiffany, 1995). In classical conditioning theory, reactivity to cues involves conditioned responses triggered by environmental cues such as people, places, odors, or situations related to past drug or alcohol consumption (Childress et al., 1993; O'Brien, Childress, McLellan, & Ehrman, 1993; Prakash & Das, 1993; Satel, 1992; Wallace, 1989; Washton, 1987). Over time it is assumed that these stimuli, by virtue of their pairing with the unconditioned drug stimulus, become conditioned stimuli capable of eliciting conditioned responses in the form of reactions such as increased craving, skin responses, and heart rate. Presumably, these cue-specific reactions reflect motivational processes responsible for continuing drug use in addicts as well as relapse in addicts attempting to remain abstinent.

Traditionally, laboratory-based cue reactivity studies consisting of simple cue presentations suggest that visual, auditory, olfactory, and tactile cues can increase physiological arousal, subjective urges, and craving in those who abuse alcohol (Carter & Tiffany, 1999; Cooney et al., 1997; Drummond & Glautier, 1994; Glautier & Drummond, 1994; Hutchinson et al., 2001; Laberg & Ellertsen, 1987; Monti et al., 1993a,b). Monti and Rohsenow (1999) reported that relapse can often be brought about by a constellation of complex cues including mood state, social interactions, and drinking materials.

Seeking to expand beyond simple cue presentations to more realistic environments, researchers have constructed bars in the laboratory or conducted experiments in real bars to study actual drinking contexts. Often actors (confederates) are used as bar patrons, servers, and/or peers to simulate drinking interactions and experiences. Laboratory-based bars have been used to study medication effects, cue reactivity, and alcohol use expectancies in social and dependent drinkers (Anton, Drobos, Voronin, Durazo-Avizu, & Moak, 2004; Drobos, Anton, Thomas, & Voronin, 2003; Fromme & Dunn, 1992; Wall, McKee, & Hinson, 2000; Wall, McKee, Hinson, & Goldstein, 2001; Wigmore & Hinson, 1991). During experiments, ratings of alcohol expectancies are obtained in a variety of contexts (real bar vs. lab bar). In trials, participants report higher alcohol expectancies in the real bars compared to laboratory-based bars (Wall et al., 2000, 2001). These studies highlight the role of context and the need to expand cue-based research methods to incorporate more ecologically valid experimental environments.

Given the importance of cues in alcohol use and relapse, the potential for incorporation of cues into treatment approaches may be important. However, in trials with alcohol drinkers, cue exposure based intervention results are mixed and efficacy tends to be modest following treatment (Havermans & Jansen, 2003). In treatment trials, cue exposure has been tested alone (Drummond & Glautier, 1994) or combined with coping skills, cognitive behavioral, or social skills interventions (Cooney, Baker, & Pomerleau, 1983; Drummond & Glautier, 1994; Monti et al., 1993a; Rohsenow et al., 2001). Data across treatment trials suggest that cue exposure combined with coping skills training may result in increased use of skills, increases in days abstinent, and decreases in drinking (Monti & Rohsenow, 1999; Rohsenow et al., 2001). Niaura (2002) contends that coping skills need to be acquired and practiced in contexts that are congruent with real world environments where drug or alcohol use occurs; in addition, developing cue exposure methods based on technologies that provide real world simulations, such as virtual environments, are proposed to advance this technique into treatment and research settings.

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